
NEW SPECIES OF *PANICUM*
SUBGENUS *DICHANTHELIUM*
(POACEAE: PANICEAE)
FROM SOUTH AMERICA

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ABSTRACT

Six new species of the pantropical genus *Panicum* subg. *Dichanthelium* (Poaceae: Paniceae) are described, illustrated, and compared with the putative most closely related species. Five of these species, *P. heliophilum*, *P. adenorhachis*, *P. cabreræ*, *P. petropolitanum*, and *P. cucaense*, are found in campos rupestres, which are high-altitude rocky fields of Brazil. *Panicum davidsei* is restricted to elevated savannas of Venezuela and northwestern Brazil.

During the revision of *Panicum* for America by the senior author, six new species were discovered in South America, all of which belong in subg. *Dichanthelium* A. Hitchc. & Chase.

Subgenus *Dichanthelium* was traditionally characterized (Hitchcock & Chase, 1910, 1915; Pilger, 1940; Hsu, 1965) as having two vegetative phases: one with a rosette of short, broad leaves formed during autumn and winter that produce primary panicles with chasmogamous spikelets on elongated shoots in spring; and the other with fascicles of short branches that produce secondary panicles with cleistogamous spikelets during spring, summer, and autumn.

Gould (1974) recognized *Dichanthelium* at the generic level, an idea followed by a number of different authors (e.g., Brown & Smith, 1975; Clark & Gould, 1975; Gould & Clark, 1978; Gould, 1980; Hansen & Wunderlin, 1988).

Pohl (1980) and Zuloaga (1987) reported variation in the vegetative characters among Central and South American species of *Dichanthelium*. Lelong (1984), Zuloaga (1987), and Webster (1988) recognized *Dichanthelium* as a subgenus of *Panicum*. Due to the absence of rosette and chasmogamous and cleistogamous panicles on the Central and South American species of the subgenus, it can be recognized by having inflorescences lax and diffuse, spikelets ellipsoid to obovoid, with the upper antherium indurate, smooth, with simple papillae on its surface, and apiculate, the apicule covered with stomata and with or without unicellular macrohairs. The leaf anatomy is uniform in the subgenus and is non-Kranz, with two bundle sheaths around the vascular bundles, the

mesophyll irregularly radiate around the vascular bundles, and with extensions of the parenchymatous sheath present toward both surfaces of the blade.

Within subg. *Dichanthelium*, the new species are placed in sect. *Dichanthelium* because of their membranous-ciliate ligules, spikelets with the upper glume and lower lemma 7–9(–14)-nerved, the upper antherium apiculate and papillate, with simple papillae regularly distributed, and the upper lemma apically pilose or scabrous.

Five of these species are found in Brazil, in campos rupestres, rocky fields at moderate altitudes 1,000–1,800 m (Eiten, 1978), or in rocky mountains of higher altitudes (over 2,000 m) near Rio de Janeiro. The other species grows in elevated savannas in Venezuela and northwestern Brazil.

Panicum heliophilum Chase ex Zuloaga & Morrone, sp. nov. TYPE: Brazil. Minas Gerais: Chapeo de Sol, Serra do Cipó, 110 km NE of Belo Horizonte, 900 m, 28 Mar.–1 Apr. 1925, A. Chase 9147 (holotype, US; isotypes, F, GH, MO). Figure 1.

Panicum pycnocladus Tutin affine sed spiculis hirsutis sine stipite, et foliis rigidis, lineari-lanceolatis, basi subcordatis differt.

Plants perennial, short-rhizomatous. Culms 50–70(–100) cm tall, many-noded, tangled, leaning on the adjacent vegetation, the basal portion decumbent and geniculate, the upper portion erect, freely branching; internodes cylindrical, pilose, solid toward the base, otherwise hollow; nodes villous. Sheaths striate, 0.5–4 cm long, strongly distichous,

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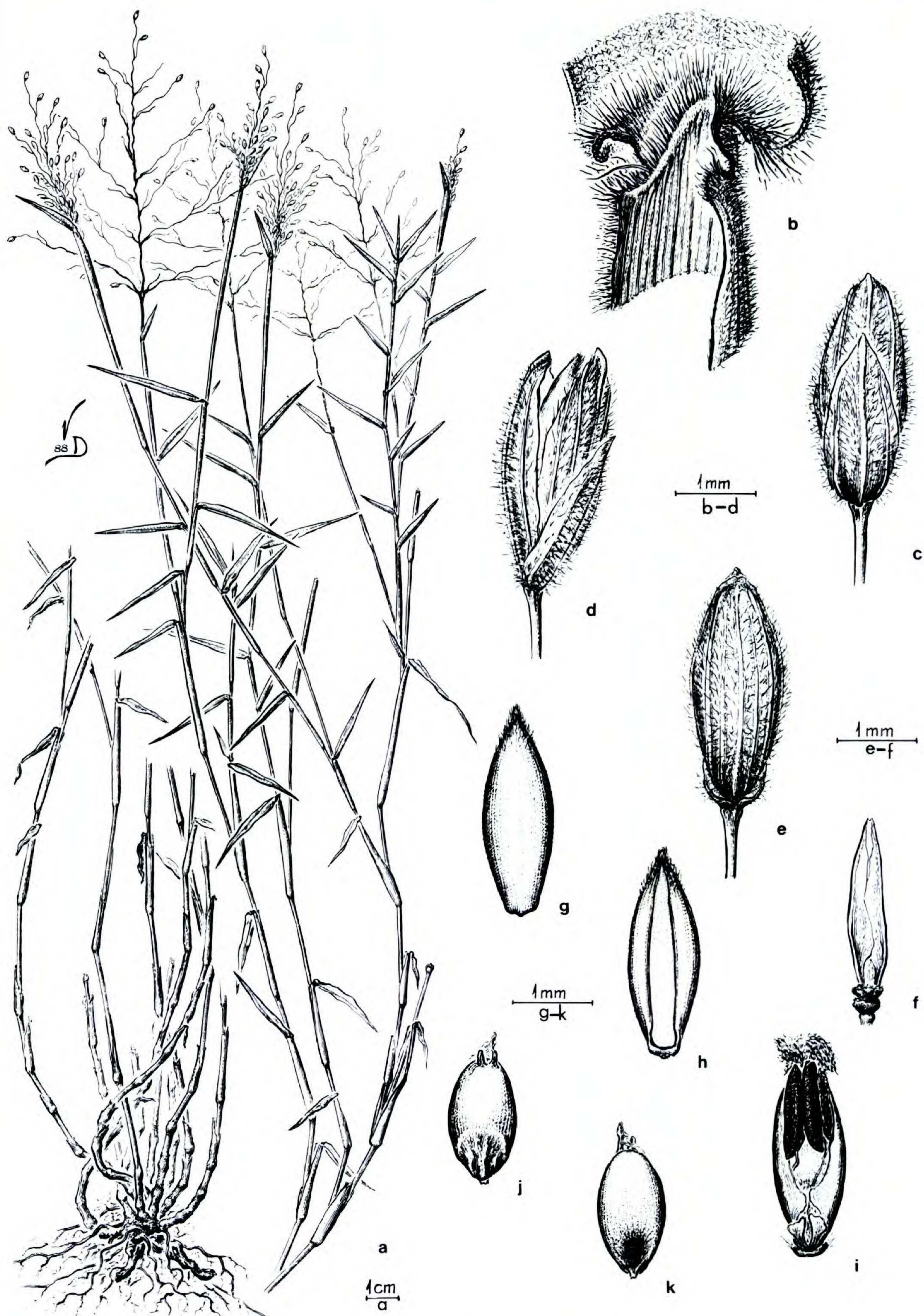


FIGURE 1. Holotype of *Panicum heliophilum*. —a. Habit. —b. Ligule. —c. Spikelet, ventral view. —d. Spikelet, lateral view. —e. Spikelet, dorsal view. —f. Lower palea. —g. Upper antherium, dorsal view. —h. Upper antherium, ventral view. —i. Upper palea with lodicules, stamens, and stigmas. —j. Caryopsis, embryo side. —k. Caryopsis, hilum side.

hispid with short hairs, the margins long-ciliate; auricles small, pilose; collar brownish to purplish, covered with short, whitish hairs; ligule a ciliate membrane, 0.2–0.7 mm long, the cilia 0.1–0.6 mm long; blades linear-lanceolate, 4–5(–12) cm long, 0.3(–1) cm wide, subcordate, densely hirsute on both surfaces, flat or folded, the margins cartilaginous, scabrous, and short-ciliate. Primary panicles lax, diffuse, 4–16 cm long, 3–13 cm wide; peduncles hispid, up to 8 cm long; branches opposite or alternate, the lower ones sometimes whorled, diverging from the axis; rachis flexuous, sparsely hirsute, the axes of the branches short-hirsute or glabrous, the axils of the branches brownish, hispid; pedicels smooth, glabrous, 2–13 mm long. Secondary panicles similar to the terminal one, smaller. Spikelets solitary, ellipsoid, 2.6–3.1 mm long, 1–1.1 mm wide, hirsute, greenish, without a stipe between the lower and upper glume; lower glume 2–2.7 mm long, $\frac{3}{4}$ the length of the spikelet, acuminate, 3-nerved, the nerves anastomosed toward the distal portion; upper glume and lower lemma subequal, 7-nerved; lower palea elliptic, 2 mm long, 0.3 mm wide, hyaline; lower flower absent; upper antherium long-ellipsoid, 2.4–2.7 mm long, 0.8–0.9 mm wide, stramineous, brownish at maturity, papillose, with simple papillae evenly distributed, densely pilose, with appressed, long hairs toward the apex of lemma and palea; upper lemma 5–7-nerved; rachilla prolonged or not into a short mucro above the upper antherium; lodicules 2, fleshy, conduplicate, truncate, ca. 0.6 mm long; stamens 3, the anthers ca. 1.3 mm long, purplish; stigmas plumose. Caryopsis ellipsoid, 1.4 mm long, 0.8 mm wide, brownish; hilum oblong; embryo $\frac{1}{3}$ the length of the caryopsis.

Paratypes. BRAZIL. MINAS GERAIS: Diamantina, summit of Serra de San Antonio, 1,400 m, 27–30 Dec. 1929, *A. Chase 10354* (US); Mun. Jaboticatubas, Lagoa Santa a Conceição do Mato Dentro, 27 July 1977, *Sendulsky & Burman 1920* (SI, SP); km 114 ao largo da rodovia Lagoa Santa–Conceição do Mato Dentro, 1,160 m, *Sendulsky 1609* (SP); Serra de Santo Antonio, 2–5 km ao leste da cidade de Diamantina, 1,050–1,100 m, 10 Feb. 1982, *Burman & Sendulsky 696, 697, 709* (SI, SP); Serra do Cipó, ao longo da rodovia Lagoa Santa–Conceição, 9 Dec. 1971, *Sendulsky 446* (SP); Serra do Cipó, 25 Feb. 1979, *Burman 525* (SP), 24 June 1979, *Burman 485* (SP).

Panicum heliophilum is most closely related to *P. pycnocladus* Tutin, from which it differs by having hirsute, nonstipitate spikelets and stiff, linear-lanceolate blades with subcordate bases. *Panicum pycnocladus* has glabrous to sparsely hispid spikelets and lax, lanceolate to ovate-lanceolate blades that are cordate and amplexicaulous.

Panicum heliophilum is also related to *P. assurgens* Renvoize; it differs by having leaf blades linear-lanceolate, rigid, usually folded and densely hirsute, and spikelets hirsute 2.6–3.1 mm long. *Panicum assurgens* has leaf blades lanceolate, flat, herbaceous, sparsely hispid, and spikelets puberulous to glabrous, 3.3 mm long.

Some of the specimens examined have the rachilla prolonged above the upper antherium as a short mucro, a character also present in other genera of Paniceae [*Lasiacis grisebachii* (Nash) A. Hitchc. and *L. ruscifolia* (HBK) A. Hitchc. (Davidse, 1978); *Brachiaria tatianae* Zuloaga & Soderstrom (Zuloaga & Soderstrom, 1985)].

In *Panicum heliophilum* the lower leaf blades abscise, leaving the dry leaf sheaths on the culms. This is probably an adaptation to the seasonally dry habitat. It also occurs in *P. adenorhachis*, *P. cabreræ*, and *P. cucaense*, species that grow in a similar habitat.

Panicum heliophilum grows in campos rupestres of the state of Minas Gerais, Brazil, between 900 and 1,400 m elevation. It is common in sandy soils, where it is found, according to notes on *Chase 9147*, “in dry rocks, leaning out, tangled with *Echinolaena inflexa* and resembling it.”

Panicum adenorhachis Zuloaga & Morrone, sp. nov. TYPE: Brazil. Bahia: Mun. Rio de Contas, 6–10 km ao NW de Rio de Contas, na estrada para o Pico das Almas, 13°32'S, 41°53'W, 1,000 m, 21 July 1979, *S. A. Mori, R. M. King, T. S. dos Santos & J. L. Hage 12451a* (holotype, CEPEC; isotypes, MO, US). Figure 2.

Panicum stipiflorum Renvoize affine sed foliis lanceolatis, glandulosis et spiculis 2.7–3 mm longis sine stipite, gluma inferiore quam spicula $\frac{1}{3}$ vel minus longiore, enervia vel uninervia differt.

Plants perennial. Culms trailing, leaning over the adjacent vegetation, many-noded, sparingly branched; internodes cylindrical, hollow, glabrous; nodes brownish, short-pilose or glabrous. Sheaths striate, caducous, glabrous, covered with small glands, the margins long-ciliate; collar short-pilose, ligule a ciliate membrane, 0.2–0.6 mm long; blades narrowly lanceolate, flat, 4–6 cm long, 0.3–0.5 cm wide, subcordate, the adaxial surface scabrous, the abaxial surface glabrous and covered with small glands, the basal margins long-ciliate with tuberculate hairs but otherwise scabrous. Primary panicles lax, diffuse, few-flowered, 5–7 cm long, 4–5 cm wide; rachis wavy and glandular, the nodes distant; branches widely divergent, solitary at each

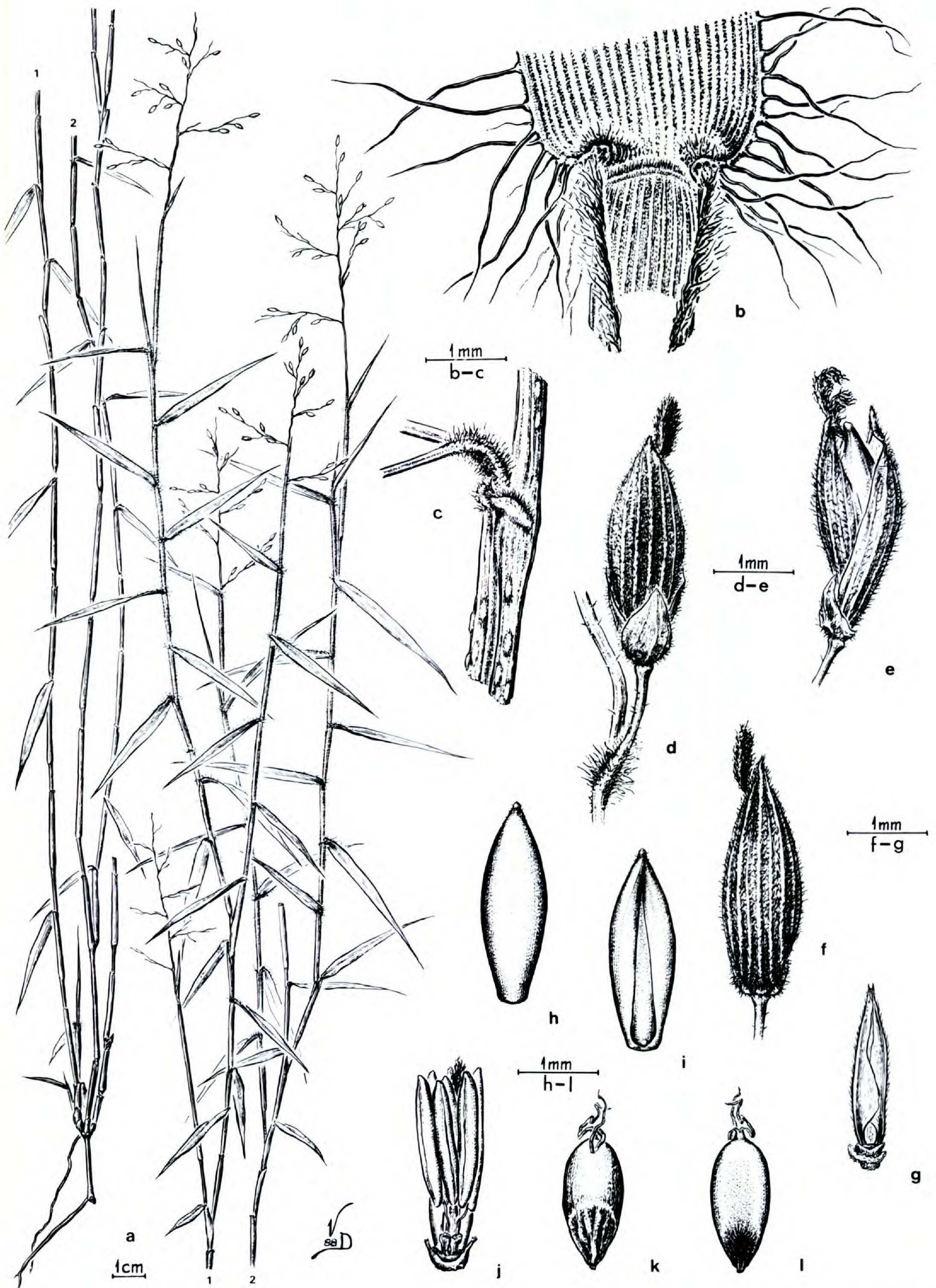


FIGURE 2. Holotype of *Panicum adenorhachis*. —a. Habit. —b. Ligule. —c. Axis of the panicle with glands. —d. Pedicel and spikelet, ventral view. —e. Spikelet, lateral view. —f. Spikelet, dorsal view. —g. Lower palea. —h. Upper antheridium, dorsal view. —i. Upper antheridium, ventral view. —j. Upper palea with lodicules and stamens. —k. Caryopsis, embryo side. —l. Caryopsis, hilum side.

node with scabrous and glandular axes and long-pilose axils; pedicels claviform, short pilose. Secondary panicles similar to the terminal one. Spikelets solitary and widely spaced, long-ellipsoid, 2.7–3 mm long, 0.9 mm wide; lower glume 0.7–0.8 mm long, less than $\frac{1}{3}$ the length of the spikelet, acuminate, enervate to 1-nerved, hyaline; upper glume and lower lemma 9-nerved, short-hispid, subequal, longer or shorter than the upper antheridium; stipe lacking between the lower and upper glume; lower palea lanceolate, 1.8 mm long, 0.4 mm wide, hyaline, ciliolate on the margins; lower flower absent; upper antheridium long-ellipsoid, 2.3 mm long, 0.8 mm wide, stramineous, brownish at maturity, papillose with simple papillae in longitudinal rows; upper lemma short-mucronate and with small macrohairs at the apex; rachilla prolonged beyond the upper antheridium as a short mucro; lodicules 2, conduplicate, truncate, ca. 0.3 mm long; stamens 3, the anthers 1.5 mm long; stigmas plumose. Caryopsis ellipsoid, brownish, 1.5 mm long, 0.7 mm wide; hilum punctiform; embryo less than $\frac{1}{2}$ the length of the caryopsis.

Paratype. BRAZIL. BAHIA: Alto do Pico das Almas, 1,850 m, 20 Feb. 1987, *Harley et al.* 24460 (K).

Renvoize (1984) treated the collection *Mori et al.* 12451a as *P. stipiflorum* Renvoize. *Panicum adenorhachis* differs from *P. stipiflorum* by having lanceolate blades that are attenuate at the base, scabrous adaxially, and glandular abaxially; non-stipitate spikelets 2.7–3 mm long; enervate or 1-nerved lower glume that is less than $\frac{1}{3}$ the length of the spikelet; and the evidently glandular rachises of the panicles.

Panicum stipiflorum has leaf blades ovate-lanceolate, cordate and amplexicaul, densely to sparsely hirsute on both surfaces, without glands; spikelets 2–2.6 mm long, with a manifest stipe between the lower and upper glume, lower glume 3–5-nerved, $\frac{1}{2}$ (occasionally $\frac{2}{3}$) the length of the spikelet, and rachis of the inflorescence without glands.

Panicum cumbucana Renvoize differs from *P. adenorhachis* by having nonglandular, short (1–2 cm), and narrow (0.3–0.6 cm) blades that are cordate at the base; nonglandular rachises; stipitate spikelets 1.9–2.4 mm long; and lower glumes (1–)3-nerved, $\frac{1}{2}$ the length of the spikelet.

Panicum adenorhachis has glands on the leaf blades and panicles, a feature also present in other species of subg. *Dichanthelium*, e.g., *P. sabulorum* Lam., *P. stigmosum* Trin., *P. strigosum* Muhl., and *P. sphaerocarpon* Elliott.

Panicum adenorhachis inhabits campos rupestres of the state of Bahia, Brazil.

***Panicum cabreræ* Zuloaga & Morrone, sp. nov.**

TYPE: Brazil. Bahia: Mun. Rio de Contas, Pico das Almas, a 18 km ao SNW de Rio de Contas, 13°33'S, 41°57'W, 1,600–1,850 m, 22 July 1979, *S. A. Mori, R. M. King, T. S. dos Santos & J. L. Hage* 12475 (holotype, CEPEC; isotypes, MO, US). Figure 3.

Panicum stipiflorum Renvoize affine sed reclinatum, foliis lineari-lanceolatis, basi attenuatis, longe pilosis sine marginibus ciliatis differt.

Plants perennial. Culms ca. 50 cm tall, leaning over the vegetation, many-noded, sparingly branched; internodes cylindrical, hollow, sparsely pilose with whitish hairs; nodes densely pilose with long, whitish hairs. Sheaths striate, 1.5–2 cm long, longer than the internodes, long-hispid, the margins pilose with whitish hairs, especially toward the upper portion; auricles small, pilose; collar pilose; ligule a ciliate membrane, ca. 0.2 mm long; blades linear-lanceolate, 4–6 cm long, 0.2 cm wide, basally attenuate, apically acuminate, densely pilose, with long, whitish hairs on both surfaces, caducous at maturity, the margins involute. Panicles lax, diffuse, 4.5–6 cm long, 3.5–6 cm wide; peduncles hispid, 5–7 cm long; rachis cylindrical, densely hispid on the lower portion, otherwise glabrous, the nodes distant; branches alternate, divergent and reflexed, basally hispid, distally glabrous, the axils pilose to glabrous; pedicels claviform, smooth, glabrous, 2–9 mm long. Spikelets solitary, ellipsoid, 2–2.3 mm long, 0.8–0.9 mm wide, plano-convex, hirsute with whitish hairs on the glumes and lower lemma; lower glume 1.1–1.3 mm long, nearly $\frac{1}{2}$ the length of the spikelet, 3-nerved, acute, a small stipe present between the lower and upper glume; upper glume 9-nerved, the nerves anastomosing toward the apex; lower lemma 9-nerved; lower palea lanceolate, 1.5–1.8 mm long, 0.3 mm wide, glabrous, truncate, hyaline; lower flower absent; upper antheridium ellipsoid, 1.9 mm long, 0.7 mm wide, papillose, with simple papillae all over its surface, glabrous or with a few microhairs toward the apiculate apex; rachilla prolonged or not beyond the upper antheridium as a short mucro; lodicules 2, truncate, ca. 0.2 mm long; stamens 3, the anthers 1.2 mm long; stigmas plumose. Caryopsis obovoid, 1.1 mm long; hilum oblong; embryo less than $\frac{1}{3}$ the length of the caryopsis.

Panicum cabreræ is related to *P. stipiflorum*, *P. adenorhachis*, and *P. congestum* Renvoize. *Panicum stipiflorum* has ovate-lanceolate, cordate, glabrous to short-pilose blades with ciliate margins, upper antheridium pilose at apex, and culms decumbent and prostrate at the base, then becom-

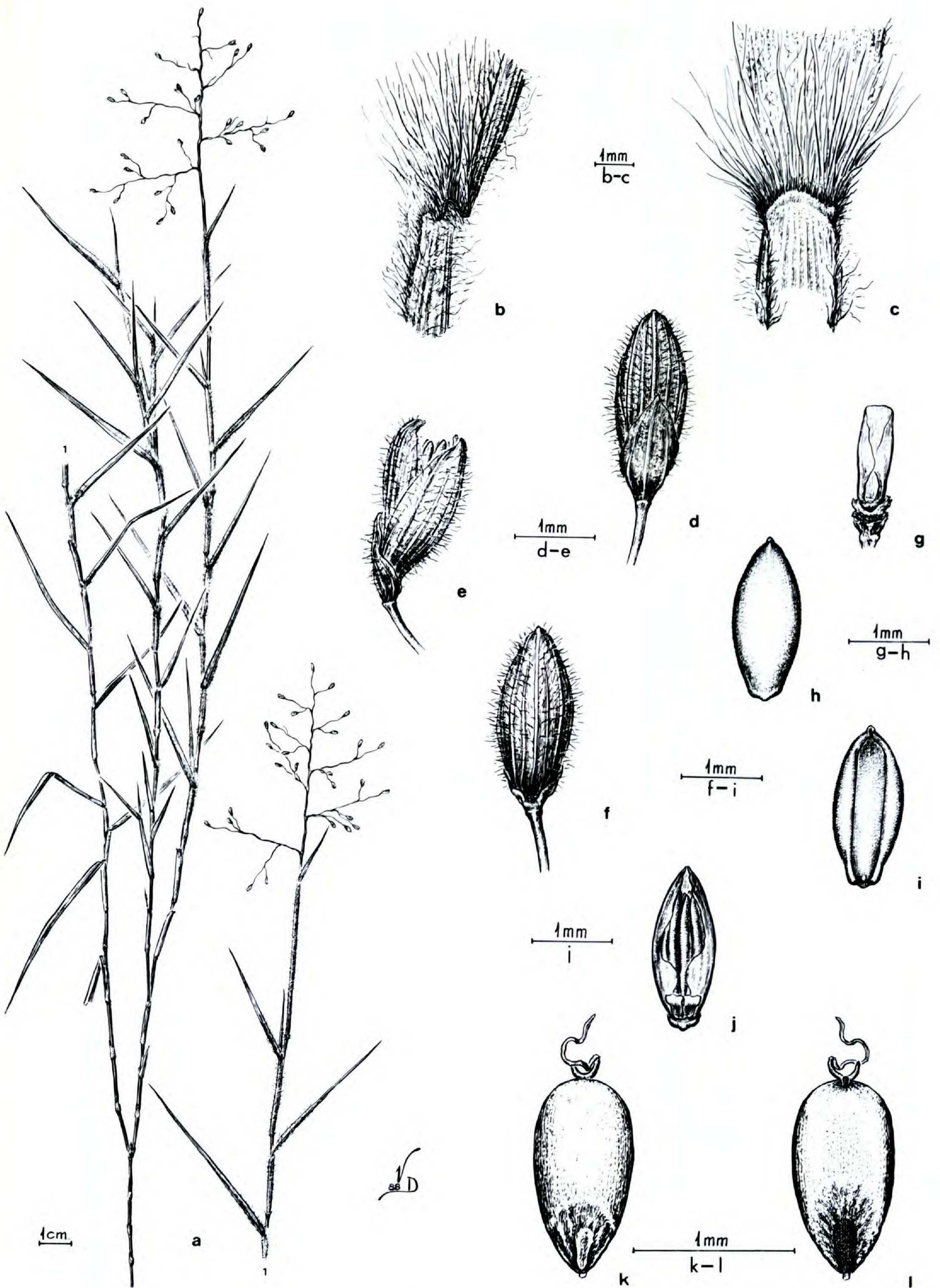


FIGURE 3. Holotype of *Panicum cabreriae*. —a. Habit. —b. Sheath and lower portion of a leaf blade. —c. Ligule. —d. Spikelet, ventral view. —e. Spikelet, lateral view. —f. Spikelet, dorsal view. —g. Lower palea. —h. Upper antherium, dorsal view. —i. Upper antherium, ventral view. —j. Upper palea with lodicules and stamens. —k. Caryopsis, embryo side. —l. Caryopsis, hilum side.

ing erect. *Panicum adenorrhachis* has, in relation to *P. cabreræ*, bigger, short-hispid spikelets, glands on the leaf blades and panicles, a lower glume less than $\frac{1}{3}$ the length of the spikelet, and spikelets nonstipitate between the lower and upper glume. *Panicum congestum* differs from *P. cabreræ*, *P. stipiflorum*, and *P. adenorrhachis* by having spikelets 2.8–3.2 mm long, with a lower glume $\frac{3}{4}$ the length of the spikelet, panicles partially included in the leaf sheaths and few-flowered, with only two or three spikelets per panicle.

The holotype of *P. cabreræ*, Mori et al. 12475 (CEPEC), was treated as *P. stipiflorum* by Renvoize (1984).

Panicum cabreræ grows in a habitat similar to that of *P. adenorrhachis*.

We name this species in honor of Angel L. Cabrera, major professor of the senior author, who is especially grateful for the training in systematics provided by Prof. Cabrera.

Panicum davidsei Zuloaga & Morrone, sp. nov.

TYPE: Venezuela. Bolívar: Cabanayén, La Gran Sabana, wet inundated savanna, 1,300 m, 3 Dec. 1973, G. Davidse, M. Ramia & R. Montes 4796 (holotype, MO). Figure 4.

Panicum assurgens Renvoize affine sed spiculis stipitatis, gluma superiore 12–14-nervia et lemma inferiore 10–12-nervia; lemma superiore conspicue apiculata cum marginibus superioribus membranaceis differt.

Plants perennial. Culms 0.50–1.80 m long, decumbent, rooting and branching at the lower nodes, the upper portions erect; internodes 8–22 cm long, cylindrical, striate, hispid, compressed; nodes hirsute. Sheaths 5–8 cm long, sparsely hirsute with long tuberculate hairs, one of the margins long-ciliate, the other membranous; collar long-pilose with whitish hairs; ligule membranous-ciliate, ca. 0.2 mm long; blades narrowly lanceolate, 9–13 cm long, 1–1.3 cm wide, flat, subcordate, the apex acuminate, adaxial surfaces long-pilose toward the base, otherwise glabrous, abaxial surfaces sparsely pilose, the margins scabrous and ciliate toward the base, the midnerve conspicuous. Panicles lax, diffuse, 12–20 cm long, 7–12 cm wide; peduncle 10–40 cm long; rachis cylindrical, striate, pilose near the branches, otherwise glabrous; lower branches whorled, the upper ones subopposite or alternate, the axes of the branches flexuous, glabrous, the axils of the branches pilose; pedicels glabrous, wavy. Spikelets solitary, ellipsoid, 3–3.3 mm long, 1 mm wide, scaberulous, attenuate toward the base and with a small stipe between the lower and upper glume; lower glume ovate-acuminate, 1.5–1.8 mm

long, nearly $\frac{1}{2}$ the length of the spikelet, 3-nerved; upper glume 2.4–2.7 mm long, not covering the apex of the upper antherium, 11–14-nerved; upper glume and lower lemma subequal with manifest nerves anastomosed toward the apex; lower lemma ca. 2.7 mm long, 10–12-nerved; lower palea lanceolate, 2.1–2.4 mm long, 0.3 mm wide, glabrous, hyaline; lower flower absent; upper antherium ellipsoid, 2.4–2.7 mm long, 1 mm wide, papillose, apiculate; upper lemma with a green, scabrous crest on the apex and the upper margins membranous, prolonged toward the apex as small wings; rachilla prolonged beyond the upper antherium as a small mucro; lodicules 2, conduplicate, truncate, ca. 0.4 mm long; stamens 3, the anthers ca. 1.2 mm long; stigmas plumose. Caryopsis ellipsoid, 1.8 mm long; 0.9 cm wide; hilum punctiform; embryo $\frac{1}{3}$ the length of the caryopsis.

Paratypes. BRAZIL. RORAIMA: aldeia do Tuchana, Rondón s.n., July 1927 (RB 110786). VENEZUELA. BOLÍVAR: entre Piedra de La Virgen y la parte alta de La Escalera, carretera a La Gran Sabana, 6°0'N, 61°25'W, 1,300 m, 12 Ago. 1989, Zuloaga et al. 4406 (MO, SI, VEN); a 1 km al sur de Puente Sakaika, La Gran Sabana, 1,200 m, 13 Ago. 1989, Zuloaga et al. 4427 (MO, SI, VEN).

This species is allied to *P. assurgens* Renvoize. *Panicum assurgens* differs from *P. davidsei* by the nonstipitate spikelets, the 9-nerved upper glume and lower lemma, the lower glume $\frac{3}{4}$ – $\frac{4}{5}$ as long as the spikelet, and the apiculate upper lemma with indurate, not membranous upper margins.

The large number of nerves on the upper glume and lower lemma of this new species suggest a relationship to *P. itatiaiae* Swallen, a Brazilian species described from Rio de Janeiro with spikelets 4.6–4.9 mm long, 1.6–1.7 mm wide. *Panicum davidsei* has spikelets 3–3.3 mm long, 1 mm wide.

Panicum davidsei grows in savannas of the Gran Sabana, Venezuela, and Brazil, Roraima, at the edge of the forests, together with plants of *P. pycnocladus*.

We name this species in honor of its collector, Gerrit Davidse, renowned agrostologist of the Missouri Botanical Garden.

Panicum cucaense Zuloaga & Morrone, sp. nov.

TYPE: Brazil. Rio de Janeiro: Mun. Petrópolis, Morro do Cuca, entre Vale dos Videiras e Araras, campo de altitude, 1,600 m, 27 Jan. 1983, G. Martinelli & E. Simonis 9011 (holotype, RB; isotypes, MO, SI). Figure 5.

Panicum petropolitanum affine sed caespitosum, breviter rhizomatosum, vaginis conspicue distichis, foliis involutis et paniculis breviter pedunculatis differt.

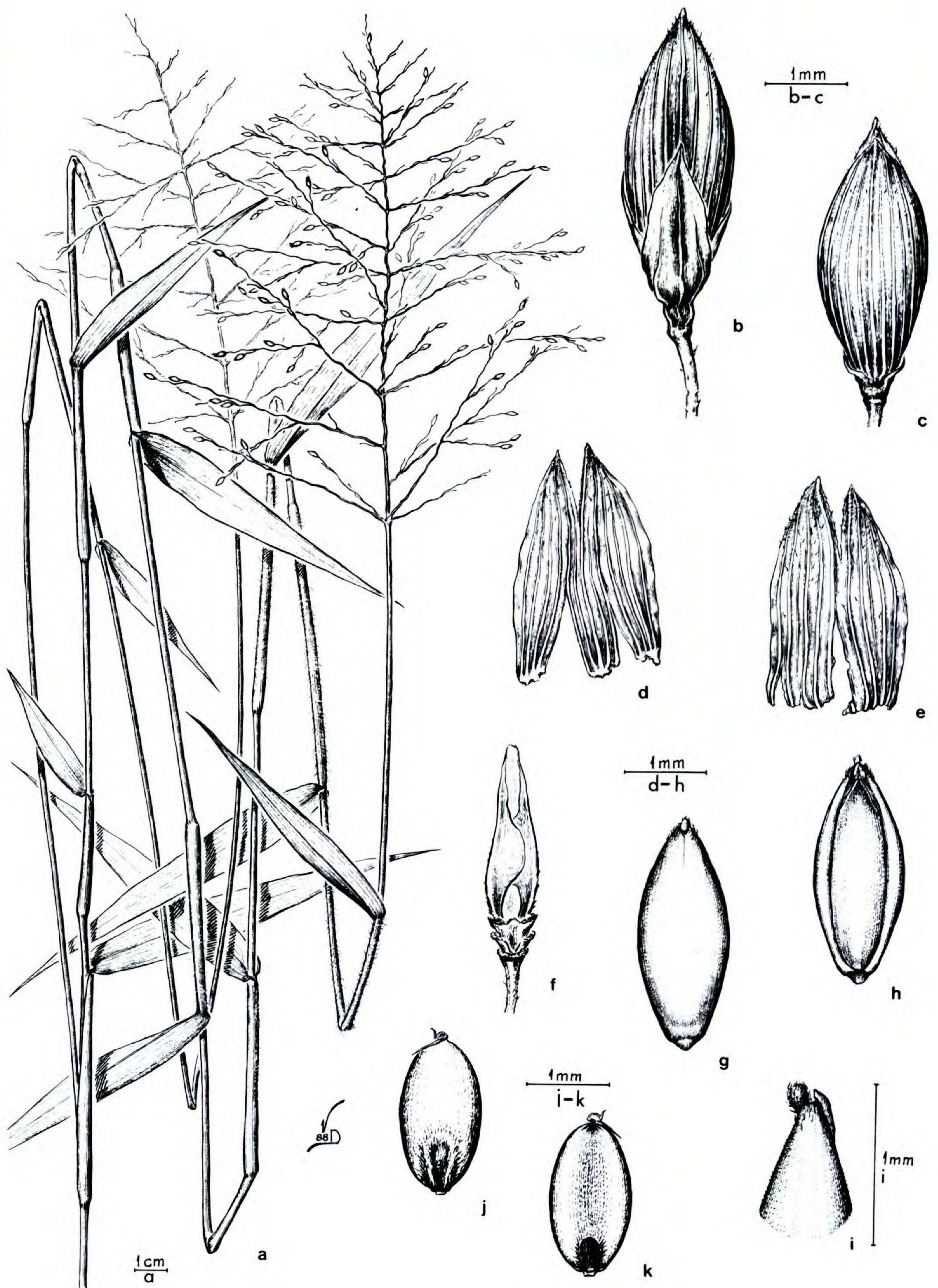


FIGURE 4. Holotype of *Panicum davidsei*.—a. Habit.—b. Spikelet, ventral view.—c. Spikelet, dorsal view.—d. Upper glume.—e. Lower lemma.—f. Lower palea.—g. Upper antherium, dorsal view.—h. Upper antherium, ventral view.—i. Upper tip of the lemma with apicule and membranous upper margins.—j. Caryopsis, embryo side.—k. Caryopsis, hilum side.

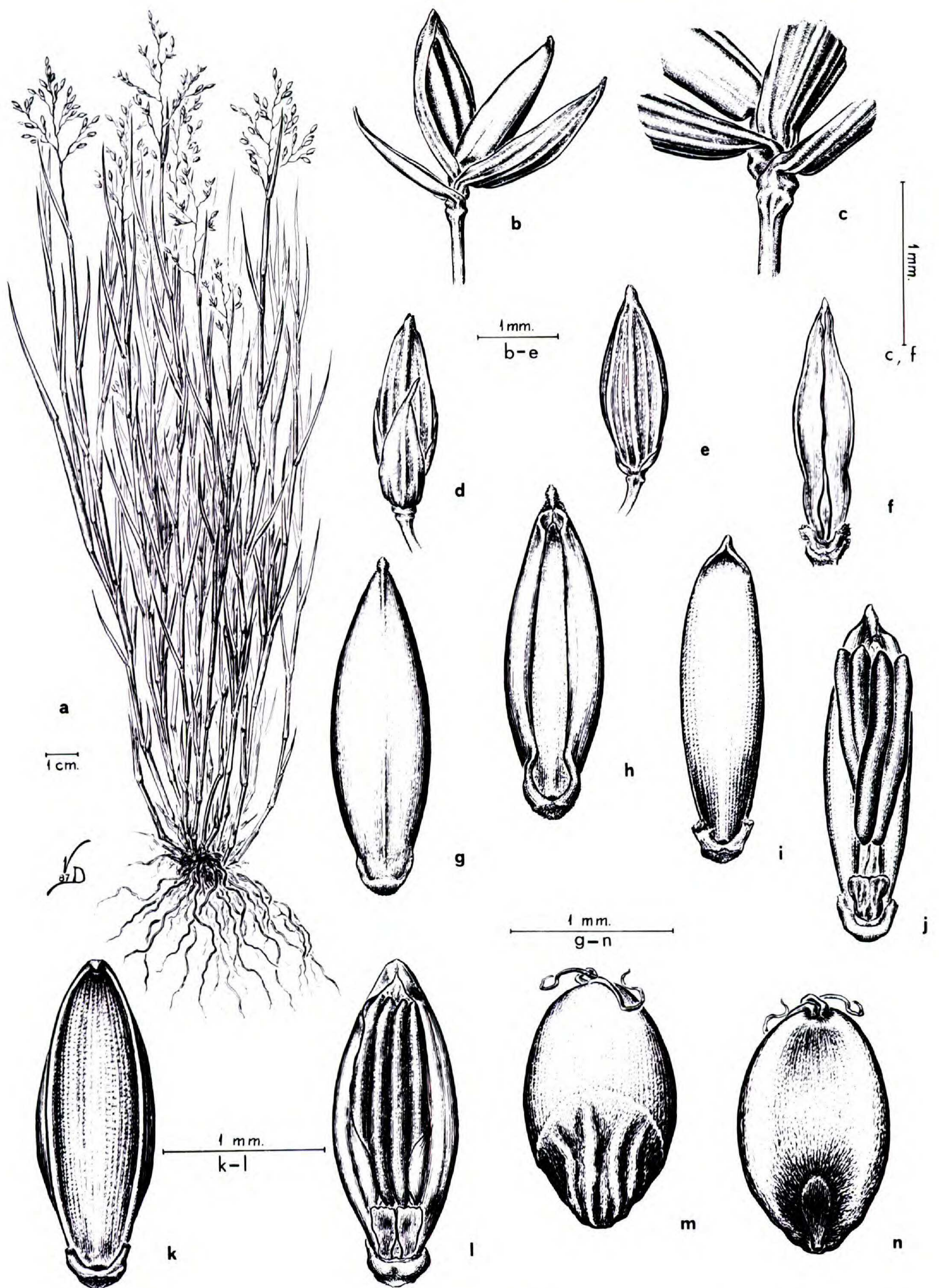


FIGURE 5. Holotype of *Panicum cucaense*. — a. Habit. — b. Spikelet, lateral view. — c. Detail of base of spikelet. — d. Spikelet, ventral view. — e. Spikelet, dorsal view. — f. Lower palea. — g. Upper antherium, dorsal view. — h. Upper antherium, ventral view. — i. Upper palea. — j. Upper palea with lodicules and anthers. — k. Upper palea. — l. Upper palea with lodicules and anthers. — m. Caryopsis, embryo side. — n. Caryopsis, hilum side.

Cespitose perennial, shortly rhizomatous. Culms 20–30 cm tall, many-noded, erect to geniculate-ascending and rooting at the lower nodes, freely branching; internodes 1–4 cm long, cylindrical, striate, glabrous; nodes compressed, glabrous, brownish. Sheaths striate, ca. 1.2 cm long, longer than the internodes, strongly distichous, long-pilose at the distal portion, otherwise glabrous, one margin pilose with long, whitish hairs, the other membranous; ligule a ciliate membrane, the membrane ca. 0.1 mm long, the cilia 0.4 mm long; blades linear, 1.5–5.5 cm long, 0.1–0.2 cm wide, folded, attenuate toward the apex, pilose adaxially toward the ligule, otherwise glabrous, the borders scabrous. Primary panicles lax, diffuse, few-flowered, 2–3.5 cm long, 1.5–3.5 cm wide; peduncles to 6 cm long, glabrous; rachis striate, wavy, glabrous, with some glands; branches alternate, divergent and widely spaced, glabrous, the axils of the branches pilose; pedicels glabrous, 1–6 mm long. Secondary panicles similar to the primary one. Spikelets solitary, ellipsoid, 2.2–2.7 mm long, 0.8–0.9 mm wide, open at maturity, glabrous; lower glume lanceolate, 1.5–1.9 mm long, $\frac{2}{3}$ – $\frac{3}{4}$ the length of the spikelet, acuminate, 1(–3)-nerved, a small stipe present between the lower and upper glume; upper glume and lower lemma subequal, 7–9-nerved, acute; lower palea lanceolate, 1.7–1.9 mm long, 0.4–0.7 mm wide, hyaline, glabrous; lower flower absent; upper antherium long-ellipsoid, 2.1–2.3 mm long, 0.7–0.8 mm wide, papillose, with simple papillae evenly distributed, apiculate, the apex scabrous, otherwise glabrous; lodicules 2, cuneiform, truncate, ca. 0.2 mm long; stamens 3, the anthers 1.2 mm long; stigmas plumose, purplish. Caryopsis ellipsoid, brownish, 1.4 mm long, 0.7 mm wide; hilum oblong; embryo less than $\frac{1}{2}$ the length of the caryopsis.

Paratypes. BRAZIL. RIO DE JANEIRO: Teresópolis, Serra dos Orgãos, Pedra do Sino, 2,100–2,170 m, Feb. 1953, *J. Vidal II-6467, II-6485* (R, SI).

Panicum cucaense is related to *P. petropolitanum* but is distinguished by its cespitose habit; erect, many-noded culms; strongly distichous leaf sheaths; stiff and folded leaf blades; and shortly exerted panicles.

Panicum petropolitanum differs from *P. cucaense* in its stoloniferous habit; culms geniculate, rooting and branching at the lower nodes, then becoming erect, few-noded; leaf blades linear-lanceolate, flat; and inflorescence with a peduncle to 16 cm long.

Panicum cucaense inhabits open and dry habitats in rocky, granitic soils of high-altitude campos

of the mountains in eastern Brazil. Eiten (1978) indicated that these rocky areas over 2,000–2,500 m (planaltos), found on mountains such as Itatiaia or the Serra dos Orgãos and with frosts occurring at night in the cold season, should be distinguished from the campos rupestres, which occur from Bahia to the state of São Paulo at lower elevations.

Panicum petropolitanum Zuloaga & Morrone, sp. nov. TYPE: Brazil. Rio de Janeiro: Mun. Petrópolis, Araras, base da Pedra Maria Comprida, saxícola, heliófila, crescendo em beira de rio, 23 Mar. 1968, *D. Sucre & P. J. Braga 2553* (holotype, RB). Figure 6.

Panicum cucaense affine sed stoloniferum, vaginis non conspicue distichis, foliis planis et paniculis longe pedunculatis differt.

Plants perennial?, stoloniferous. Culms geniculate, rooting and branching at the lower nodes, then becoming erect, freely branching, 10–25 cm tall, few-noded; internodes 1–4 cm long, cylindrical to compressed, hollow, glabrous; nodes compressed, brownish, covered with long hairs or glabrous. Sheaths striate, 1.5–5.5 cm long, longer than the internodes, one of the margins long-ciliate with whitish hairs, the other membranous or with long hairs near the ligule, glabrous on the rest of the surface; collar brownish, glabrous; ligules membranous-ciliate, ca. 0.2 mm long; blades linear-lanceolate, 2–7 cm long, 0.1–0.3 cm wide, flat, glabrous, the margins scaberulous, the apex attenuate. Panicles lax, diffuse, 2–6 cm long, 1–3.5 cm wide; peduncles to 16 cm long; rachis wavy, cylindrical, glabrous, the branches alternate, divergent and distant, the axes of the branches glabrous; axils of the branches glabrous; pedicels triquetrous, scaberulous, 1–7 mm long. Spikelets solitary, long-ellipsoid, 2.4–2.6 mm long, 0.9 mm wide, glabrous, without a stipe; lower glume 1.8–2 mm long, $\frac{3}{4}$ the length of the spikelet, lanceolate, 1(–3)-nerved, the midnerve scabrous toward the apex; upper glume (7–)9-nerved, acute, embracing the lower lemma; upper glume and lower lemma subequal; lower lemma 9-nerved, embracing the upper antherium; lower palea lanceolate, 1.5 mm long, 0.3–0.4 mm wide, hyaline, glabrous; lower flower absent; upper antherium long-ellipsoid, 2.3 mm long, 0.7 mm wide, glabrous, shiny, with simple papillae evenly distributed all over its surface; upper lemma apiculate, the apicule ca. 0.2 mm long, pilose; lodicules 2, truncate, ca. 0.3 mm long, embracing the lower margins of the palea; stamens 3, the anthers 1 mm long; stigmas plumose. Caryopsis ellipsoid, 1.2 mm long, 0.6 mm wide; hilum punc-

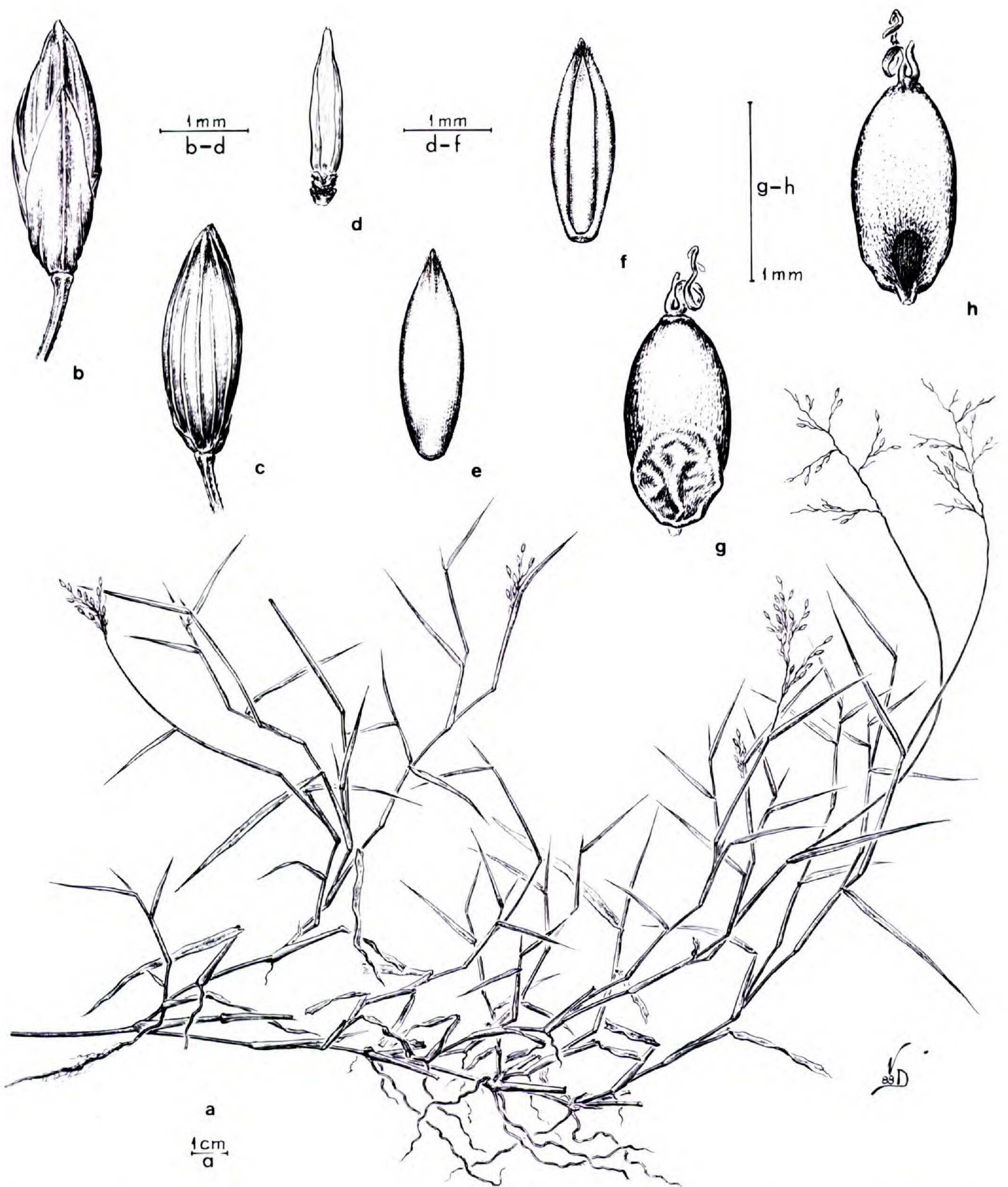


FIGURE 6. Holotype of *Panicum petropolitanum*.—a. Habit.—b. Spikelet, ventral view.—c. Spikelet, dorsal view.—d. Lower palea.—e. Upper antherium, dorsal view.—f. Upper antherium, ventral view.—g. Caryopsis, embryo side.—h. Caryopsis, hilum side.

tiform; embryo less than $\frac{1}{3}$ the length of the caryopsis.

Panicum petropolitanum is a delicate plant that grows on rocky soils in open and humid places in

borders of streams. See the discussion under *P. cucaense*.

Distinctions among the new species and related ones are summarized in the following key:

- A. Upper glume and lower lemma 11-14-nerved; panicles 12-20 cm long.
 B. Spikelets 4.6-4.9 mm long, 1.6-1.7 mm wide; lower glume 5-nerved *P. itatiaiae*
 BB. Spikelets 3-3.3 mm long, 1 mm wide; lower glume 3-nerved *P. davidsei*

- AA. Upper glume and lower lemma 7-9-nerved; panicles 1-16 cm long.
- C. Leaf blades ovate-lanceolate to lanceolate, cordate, amplexicaulous, length : width ratio 3-5 : 1.
- D. Panicles few-flowered, 1-2.5 cm long; leaf blades 1-2 cm long, 0.3-0.6 cm wide ... *P. cumbucana*
- DD. Panicles multiflowered, 3-10 cm long; leaf blades 2-12 cm long, 0.5-1.8 cm wide.
- E. Leaf blades with the margins long-ciliate, cartilaginous; lower glume to $\frac{1}{2}$ (occasionally $\frac{2}{3}$) the length of the spikelet *P. stipiflorum*
- EE. Leaf blades with the margins ciliate only at the base, otherwise scabrous, not cartilaginous; lower glume $\frac{1}{2}$ to $\frac{3}{4}$ the length of the spikelet *P. pycnocladus*
- CC. Leaf blades linear to linear-lanceolate (lanceolate in *P. assurgens*), narrowed to subcordate, not amplexicaulous, length : width ratio 12-20 : 1.
- F. Plants with conspicuous glands on the sheaths, blades and axes of the inflorescences; lower glume less than $\frac{1}{3}$ the length of the spikelet *P. adenorhachis*
- FF. Plants without glands (occasionally with a few glands on the axes of the inflorescences of *P. cucaense*), lower glume $\frac{1}{2}$ - $\frac{4}{5}$ the length of the spikelet.
- G. Spikelets 2-2.3 mm long; lower glume to $\frac{1}{2}$ the length of the spikelet *P. cabreriae*
- GG. Spikelets 2.4-3.3 mm long; lower glume $\frac{2}{3}$ - $\frac{4}{5}$ the length of the spikelet.
- H. Spikelets with a conspicuous stipe between the lower and upper glume.
- I. Spikelets glabrous, 2.2-2.7 mm long; lower glume 1(-3)-nerved; leaf blades evenly distributed along the culms *P. cucaense*
- II. Spikelets hirsute, 2.8-3.2 mm long; lower glume 5-7-nerved; leaf blades in fascicles at the top of the culms, these repeatedly branched *P. congestum*
- HH. Spikelets without a stipe between the lower and upper glume.
- J. Plants with culms 10-25 cm tall; blades 2-7 cm long, 0.1-0.3 cm wide; panicles 2-6 cm long; spikelets glabrous, 2.4-2.6 mm long *P. petropolitanum*
- JJ. Plants with culms 50-200 cm tall; blades 4-12 cm long, 0.3-1 cm wide; panicles 4-16 cm long; spikelets pilose to glabrous, 2.6-3.3 mm long.
- K. Spikelets hirsute, 2.6-3.1 mm long; leaf blades linear-lanceolate, rigid, 4-5(-12) cm long, 0.3(-1) cm wide *P. heliophilum*
- KK. Spikelets glabrous to puberulous between the nerves, 3.3 mm long; leaf blades lanceolate, herbaceous, 8-12 cm long, 0.7-1 cm wide ... *P. assurgens*

LITERATURE CITED

- BROWN, W. V. & B. N. SMITH. 1975. The genus *Dichanthelium* (Gramineae). Bull. Torrey Bot. Club 102(1): 10-13.
- CLARK, C. A. & F. W. GOULD. 1975. Some epidermal characteristics of paleas of *Dichanthelium*, *Panicum*, and *Echinochloa*. Amer. J. Bot. 62: 743-748.
- DAVIDSE, G. 1978. A systematic study of the genus *Lasiacis* (Gramineae: Paniceae). Ann. Missouri Bot. Gard. 65: 1133-1254.
- EITEN, G. 1978. A sketch of the vegetation of Central Brazil. Resumos dos trabalhos: 1-37. [Abstract of paper presented at the II Congresso Latino-Americano de Botanica, 22-29 Jan. 1978. Brasilia, Brazil.]
- GOULD, F. W. 1974. Nomenclatural changes in the Poaceae. Brittonia 26: 59-60.
- . 1980. The Mexican species of *Dichanthelium* (Poaceae). Brittonia 32(2): 353-364.
- & C. A. CLARK. 1978. *Dichanthelium* (Poaceae) in the United States and Canada. Ann. Missouri Bot. Gard. 65: 1088-1132.
- HANSEN, B. F. & R. P. WUNDERLIN. 1988. Synopsis of *Dichanthelium* (Poaceae) in Florida. Ann. Missouri Bot. Gard. 75: 1637-1657.
- HITCHCOCK, A. S. & A. CHASE. 1910. The North American species of *Panicum*. Contr. U.S. Natl. Herb. 15: 1-396.
- & ———. 1915. Tropical North American species of *Panicum*. Contr. U.S. Natl. Herb. 17: 459-539.
- HSU, C. C. 1965. The classification of *Panicum* (Gramineae) and its allies, with special reference to the characters of lodicule, style-base and lemma. J. Fac. Sci. Univ. Tokyo Sect. 3, Bot. 9: 43-150.
- LELONG, M. 1984. New combinations for *Panicum* subgenus *Panicum* and subgenus *Dichanthelium* (Poaceae) of the southeastern United States. Brittonia 36: 262-273.
- PILGER, R. 1940. Gramineae. In: A. Engler, Die Natürlichen Pflanzenfamilien, 2nd edition, 14e: 8-25.
- POHL, R. W. 1980. Gramineae. In: W. Burger (editor), Flora Costaricensis. Fieldiana, Bot. n. ser. 4: 1-608.
- RENVOIZE, S. A. 1984. The Grasses of Bahia. Royal Botanic Gardens, Kew.
- WEBSTER, R. D. 1988. Genera of the North American Paniceae (Poaceae: Panicoideae). Syst. Bot. 13: 576-609.
- ZULOAGA, F. O. 1987. Systematics of the New World species of *Panicum* (Poaceae: Paniceae). Pp. 287-306 in T. R. Soderstrom, K. W. Hilu, C. S. Campbell & M. E. Barkworth (editors), Grass Systematics and Evolution. Smithsonian Institution Press, Washington, D.C.
- & T. R. SODERSTROM. 1985. Classification of the outlying species of New World *Panicum* (Poaceae: Paniceae). Smithsonian Contr. Bot. 59: 1-63.